

We claim:

1. A method of authenticating a media signal comprising:  
transforming at least a portion of the media signal into a set of frequency  
coefficients in a frequency domain;

5         adjusting a relationship between selected frequency coefficients to a reference  
value such that an alteration to the media signal to be detected alters the relationship.

2. The method of claim 1 wherein the media signal is an image signal.

10         3. The method of claim 2 wherein the alteration to be detected is scanning,  
printing or photocopying the image signal.

15         4. The method of claim 1 wherein the relationship comprises a ratio between a  
selected coefficient and one or more neighboring coefficients.

5         5. The method of claim 4 wherein the relationship comprises a ratio between the  
magnitude of a selected coefficient and an average of neighboring coefficients.

20         6. The method of claim 1 including:  
embedding a calibration signal into the media signal to enable a detector to  
compensate for changes in scale or translation of the media signal after being adjusted  
according to the relationship.

25         7. A computer readable medium on which is stored software for performing the  
method of claim 1.

8. A detector for authenticating a media signal that has been processed according  
to the method of claim 1.

9. The detector of claim 1 including means for computing the relationship in a potentially corrupted version of the media signal and comparing the relationship with a threshold to detect alteration of the potentially corrupted media signal.

- 5           10. A method of authenticating a media signal comprising:  
            evaluating signal peaks at selected frequency coefficients of the media signal,  
            where the media signal has been previously modified to include peaks at the selected  
            frequencies; and  
            determining based on degradation of the signal peaks whether the media signal  
10     has been altered.

            11. The method of claim 10 including using one or more of the peaks to re-orient  
the media signal.

- 15           12. The method of claim 10 including:  
            correlating the media signal with a calibration signal having an arrangement of  
peaks at selected frequency coefficients to determine translation and scale of the media  
signal.  
20           13. The method of claim 12 including:  
            correlating the media signal with the calibration signal to determine rotation of the  
media signal.

25           14. The method of claim 10 wherein the media signal is an image.

            15. The method of claim 10 wherein the media signal is an audio signal.

            16. The method of claim 10 wherein the media signal is a video signal.

17. A computer readable medium having software for performing the method of claim 10.

18. A watermark decoder comprising:

5 a detector for correlating a calibration signal with a media signal suspected of carrying a watermark to determine orientation parameters describing orientation of the media signal at embedding of the watermark, where the calibration signal includes a set of peaks at selected frequency coefficients; and

10 an analyzer operable to orient the media signal using the orientation parameters and to evaluate whether the media signal has been altered after the embedding by examining signal peaks at selected frequency coefficients in the media signal.

15 19. The decoder of claim 18 wherein the detector and analyzer use at least some of the same frequency coefficients for determining orientation and evaluating whether the media signal has been altered.

20 20. The decoder of claim 18 wherein the analyzer is used to detect reproduction of a printed image by examining degradation of the media signal at selected frequency coefficients.